

Atty. Docket No. 404982

### IN THE CLAIMS

1. (Currently Amended) A method of forming a workpiece with a shaped workpiece surface having at least a portion that is axially asymmetric, the method comprising the steps of:
  - providing a ~~slow tool servo assembly having~~ a tool assembly and a spindle assembly,
  - the spindle assembly (a) securing said workpiece, and (b) being rotatable about
  - an spindle axis of rotation, and (c) having a rotary encoder to provide
  - angular position feedback of the workpiece relative to the tool assembly,
  - the tool assembly having
    - a first x-axis linear drive for moving said tool assembly in an x-axis
    - orthogonal to the spindle axis ~~of rotation,~~
    - a second z-axis linear drive for moving said tool assembly in an a z-axis
    - parallel to the spindle axis ~~of rotation,~~
    - a tool, and
    - a table, rotatable about a table axis, for manipulating an angle of the tool;
    - and
    - an encoder to provide angular position feedback of the tool relative to the
    - workpiece;
  - rotating the spindle assembly ~~between 30 revolutions per minute and 200 revolutions per~~
  - ~~minute;~~
  - ~~positioning the tool in contact with the workpiece; and~~
  - oscillating the tool assembly ~~transversely and longitudinally in~~ at least one of the x-axis
  - and the z-axis with respect to the workpiece surface such that the tool to
  - selectively removes portions of the workpiece to form the axially asymmetric
  - portion of the workpiece surface by controlling the location of a contact point of
  - the tool and workpiece along the z-axis parallel to the spindle axis of the rotation,
  - the contact point location being a function of ~~the~~ an x-axis contact point location
  - ~~of the contact point along an x-axis~~ and a function of ~~the~~ an angle of rotation of the
  - spindle about the spindle axis.
2. (Currently Amended) The method of claim 1, wherein the slow tool servo assembly further comprises a controller having a processor and wherein the method further comprises the steps of:

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- inputting a formula to the processor corresponding to a desired shape for ~~[[a]]~~the workpiece surface;
- simultaneously ~~measuring~~determining a the relative angle of rotation of the spindle about the spindle axis, and ~~the~~a relative transverse linear location of at least one of the contact point and ~~working~~the tool; and
- processing the ~~inputted~~ formula, using the ~~measured~~relative angle of rotation and the x-axis contact point location, to determine ~~the necessary~~a z-axis location ~~effor~~ at least one of the workpiece surface and tool.
3. (Currently Amended) The method of claim 1, further comprising the steps of: predetermining a slope and orientation of the workpiece surface at a specific location; and
- generating a command signal to rotate ~~[[a]]~~the table ~~upon which the tool assembly is mounted, the table rotating about a b axis orthogonal to the x axis and z axis to maintain perpendicularity of the tool relative to the workpiece surface.~~
4. (Original) The method of claim 1, wherein the tool is a grinding wheel.
5. (Original) The method of claim 1, wherein the tool is a single point diamond cutting tool.
6. (Currently Amended) An apparatus for forming an axially asymmetric portion of a workpiece surface, the apparatus comprising:
- a spindle assembly having a ~~rotatable~~ spindle for holding the workpiece, the spindle being selectively rotatable about ~~ana spindle axis of rotation, the spindle assembly having a rotary encoder to provide angular position feedback of the workpiece;~~
- and
- a tool assembly having
- a tool for contacting the workpiece,
- a first x-axis linear drive for moving said tool assembly in an x-axis ~~parallel~~orthogonal to the spindle axis ~~of rotation,~~
- a second z-axis linear drive for moving said tool assembly in ~~ana z-axis~~ orthogonalparallel to the spindle axis of the first linear drive, and

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a table that is movable along the x-axis and the z-axis through the first x-axis linear drive and the second z-axis linear drive, the table being rotatable about a table axis, the tool being mounted to the table and  
~~an angular rotation sensor to provide angular position feedback of the tool relative to the workpiece.~~

7. (Currently Amended) The apparatus of claim 6, wherein the ~~angular position sensor~~encoder is coupled to the spindle to detect ~~the an~~ angle of rotation of the spindle.

8-10. (Canceled)

11. (Currently Amended) The apparatus of claim ~~10~~ wherein the table is ~~rotatable about an axis of rotation orthogonal to said x-axis and z-axis, the rotatable table being~~ operably configured to maintain a substantially perpendicular relationship between the tool and said workpiece surface.

12. (Currently Amended) The apparatus of claim ~~11~~ wherein the tool assembly is a diamond turning machine.

13. (Currently Amended) The apparatus of claim ~~11~~ wherein the tool assembly is a grinding machine.

14. (Currently Amended) The apparatus of claim 6, ~~wherein the apparatus for forming an axially asymmetric portion of a workpiece surface further comprises~~comprising a controller for controlling at least one of said first x-axis linear drive, second z-axis linear drive and ~~the~~ relative angular rotation of the ~~rotary~~ table.

15. (Currently Amended) An apparatus for forming an axially asymmetric portion of a workpiece surface, the apparatus comprising:

a spindle assembly having a ~~rotatable~~ spindle for holding the workpiece, the spindle being selectively rotatable about ~~an a spindle axis of rotation, the spindle assembly~~  
having a rotary encoder to provide angular position feedback of the workpiece;

a tool assembly having

a tool for contacting the workpiece,

a first x-axis linear drive for moving said tool assembly in an x-axis  
~~parallel~~orthogonal to the spindle axis ~~of rotation,~~

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a second z-axis linear drive for moving said tool assembly in ~~an a~~ z-axis  
~~orthogonal~~ parallel to the spindle axis of the first linear drive, and  
a table that is movable along the x-axis and the z-axis through the first x-axis  
linear drive and the second z-axis linear drive, the table being rotatable  
about a table axis, the tool being mounted to the table  
~~an angular rotation sensor to provide angular position feedback of the tool relative~~  
~~to the workpiece; and~~  
a processor for receiving the angular position feedback and x-axis position of the tool,  
and for determining a z-axis position for the tool.

16. (Currently Amended) The apparatus of claim 15 wherein the ~~tool assembly~~  
~~further comprises a table and the tool is mounted to the table, the table being movable along the~~  
~~x-axis and z-axis through the first x-axis linear drive and the second z-axis linear drive, the table~~  
~~further being rotatable about an axis of rotation orthogonal to said x-axis and z-axis~~ processor  
determines an angle about the table axis to maintain a substantially perpendicular relationship  
between the tool and said workpiece surface.

17. (Currently Amended) The apparatus of claim ~~16~~ 15 wherein the tool ~~assembly~~ is a  
diamond turning machine.

18. (Currently Amended) The apparatus of claim ~~16~~ 15 wherein the tool assembly is a  
grinding machine.

19. (Currently Amended) The apparatus of claim 16 wherein the ~~controller~~ processor  
controls the relative angular rotation of the rotary table angle to maintain ~~the~~ [[a]] the substantially  
perpendicular relationship ~~between the tool and said workpiece surface.~~

20. (New) The method of claim 1, wherein the table axis comprises a b-axis that is  
orthogonal to the x-axis and the z-axis.

21. (New) The apparatus of claim 6, wherein the table axis comprises a b-axis that is  
orthogonal to the x-axis and the z-axis.

22. (New) The apparatus of claim 15, wherein the table axis comprises a b-axis that  
is orthogonal to the x-axis and the z-axis.